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Prepared for
Naval Electronic Laboratory Center (Code 2500)
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UNIVERSITY OF WASHINGTON
College of Engineering
Department of Electrical Engineering
Seattle, Washington 98195

Contract N00123-76-C-1451

Annual Report for the Period Ending May 31, 1977

OPTICAL FIBER CUTTING MACHINE FOR RECTANGULAR AND CIRCULAR FIBERS

Gordon L. Mitchell

June 30, 1977

Principal Investigators
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and
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San Diego, California 92152

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER

2. GOVT ACCESSION NO.

3. RECIPIENT'S CATALOG NUMBER

4. TITLE (and Subtitle)
OPTICAL FIBER CURRING MACHINE FOR RECTANGULAR AND CIRCULAR FIBERS

5. TYPE OF REPORT & PERIOD COVERED
1 June 1976 - 30 May 1977

6. PERFORMING ORG. REPORT NUMBER

7. AUTHOR(s)
Cordon L. Mitchell

8. CONTRACT OR GRANT NUMBER(s)
N00123-76-C-1451

9. PERFORMING ORGANIZATION NAME AND ADDRESS
University of Washington (FT-10)
Department of Electrical Engineering
Seattle, WA 98195

10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS

11. CONTROLLING OFFICE NAME AND ADDRESS
Naval Ocean Systems Center
San Diego, CA 92152

12. REPORT DATE
June 30, 1977

13. NUMBER OF PAGES

14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)

15. SECURITY CLASS. (of this report)
Unclassified

15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)
Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES
Principal Investigators: Gordon L. Mitchell, William D. Scott

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)
Fiber
Fracture
Splicing
Optical
Controlled Fracture

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)
An optical fiber cutting machine for use with rectangular or round cross section fibers has been developed. It combines a sliding-weight tension apparatus with a diamond knife crack initiation mechanism.

Abstract

An optical fiber cutting machine for use with rectangular or round cross section fibers has been developed. It combines a sliding-weight tension apparatus with a diamond knife crack initiation mechanism.

Efficient butt joints in optical fiber systems require that fiber ends be well finished. Since Gloge[1] published a controlled fracture fiber finishing machine a number of variations have evolved. The fiber cutting machine described in this report was designed with the following objectives:

- Capability to cut round or rectangular cross section fibers
- Convenient and reproducible adjustment of fiber tension and bending radius
- Maximum use of purchased (rather than locally fabricated) material to minimize cost.
- Simple operating procedures

The resulting fiber cutting machine is shown in Figure 1. After setting fiber tension weights with a dynamometer the fiber is clamped in the movable block and then in the fixed block. When the support slide is pulled from under the moveable block a preset tension is applied to the fiber. Fiber breakage occurs when the diamond knife is lowered to contact the fiber.

Adjustment of fiber radius and tension for clean fiber fractures is accomplished by trial and error. With the machine shown in Figure 1, a 125 μm diameter glass fiber required 300 grams tension and a 1.5" radius block for best breaks. The fiber tension can be reset within 5 grams of a desired value by positioning the sliding weights as shown in Figure 2. A tension vs. weight position calibration should be plotted for each fiber cutter constructed

REFERENCE

D. Gloge, P. W. Smith, D. L. Bisbee, E. L. Chinnock, Bell Syst. Tech. J. 52, pp. 1579-1588, (Nov. 1973).

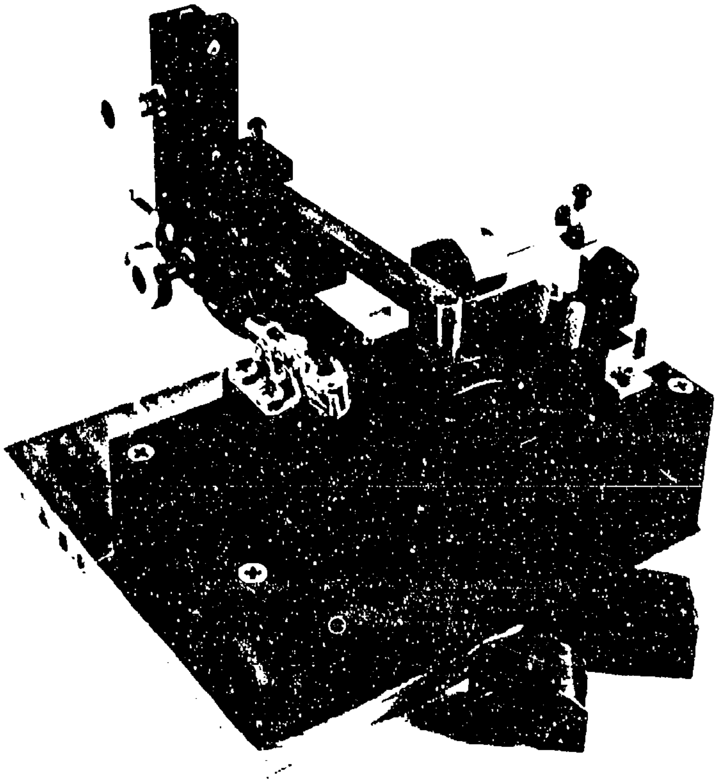


Figure 1 Fiber cutting machine. The fiber is held under tension over the radius block. When it is touched by the diamond knife a crack propagates across the fiber. If tension and radius are correct this will produce an optical quality end finish.

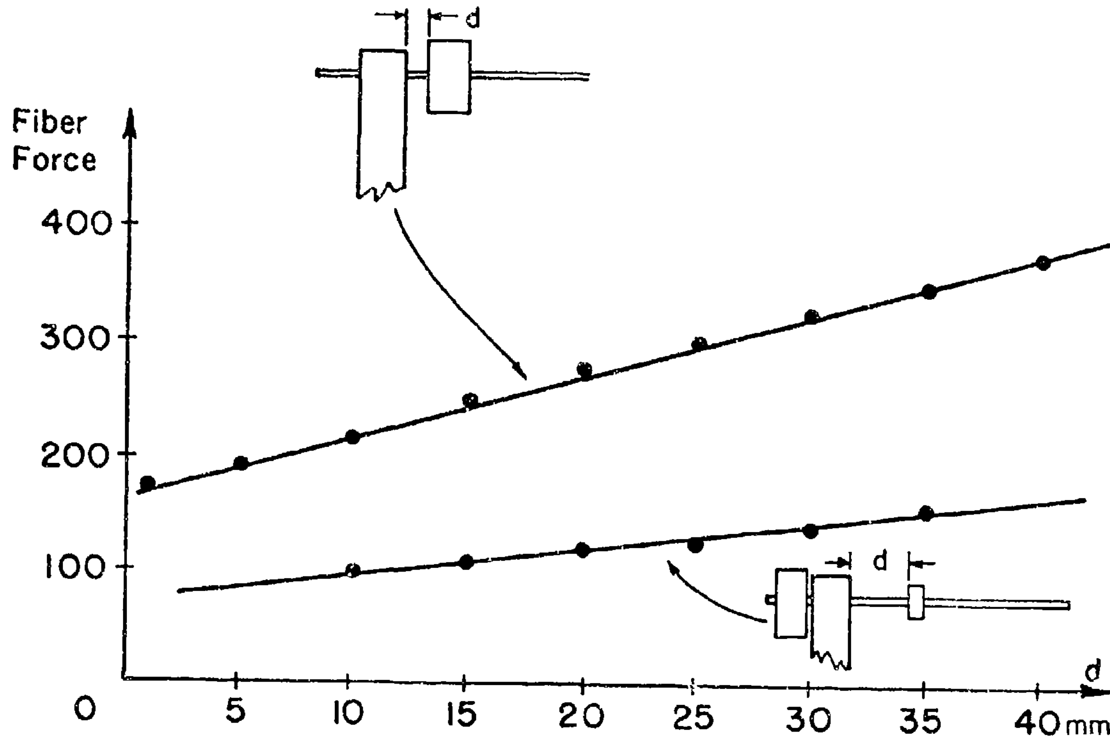


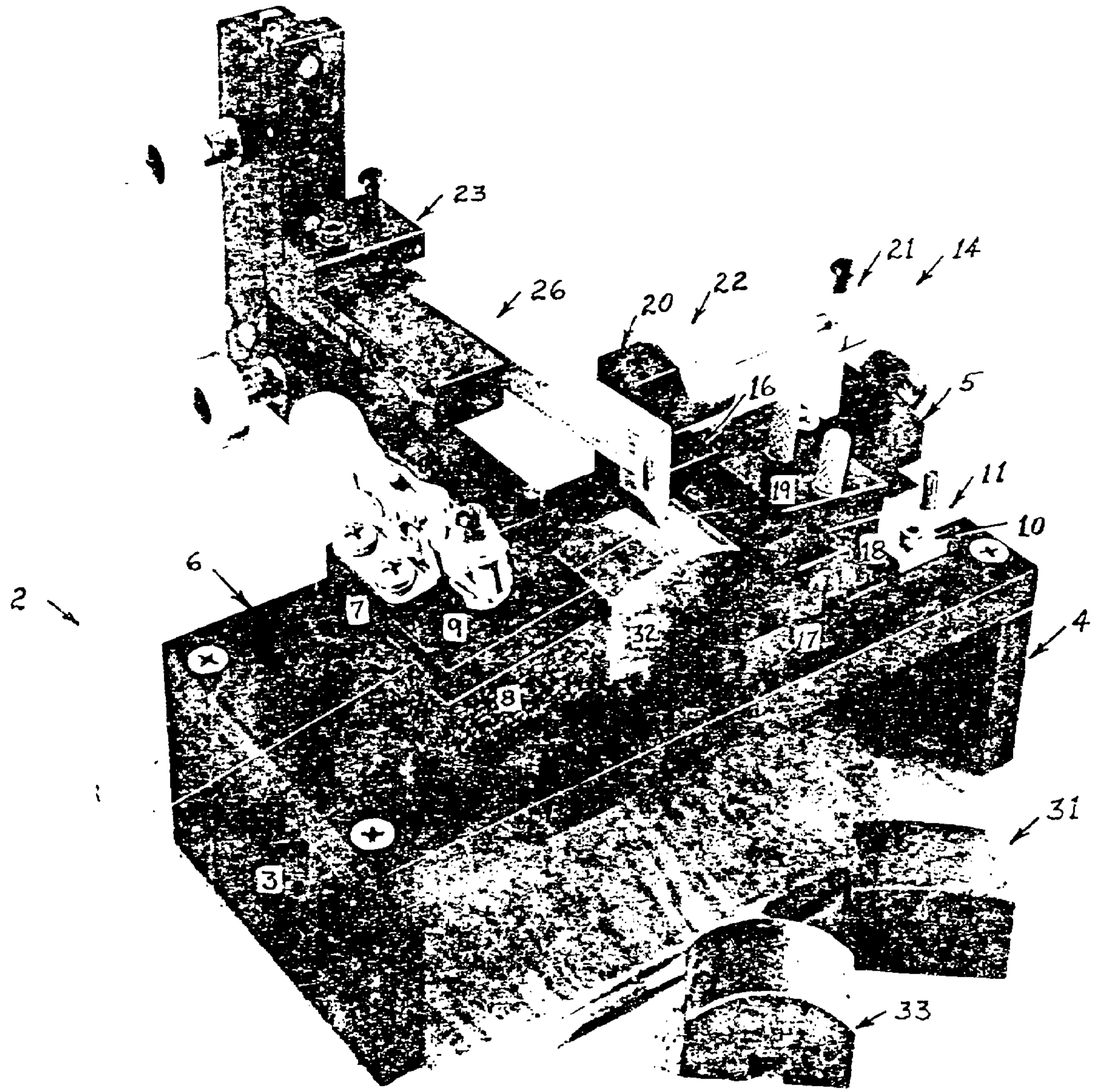
Figure 2. Fiber tension as a function of weight position for a prototype machine shown in Figure 1.

ACKNOWLEDGEMENT

The fiber cutter described in this report uses some design concepts from similar machines constructed at Bell Telephone Laboratories and the Naval Ocean Systems Center. Marcell Sollenberger fabricated the first prototypes and David Porter of the Boeing Commercial Airplane Company was responsible for design documentation.

DETAIL DRAWINGS

FIBER CUTTING MACHINE



REV LTR

		QTY	PART NUMBER	DESCRIPTION	SPECIFICATION	REV
		4	MS51977-11	SET SCREW	-	
		1	MS51977-10	SET SCREW	-	
		1	MS171431	PIN	SPRING	
		1	MS171525	PIN	SPRING	
		1	NAS1189-08-4	SCREW	FLAT HEAD	
		6	NAS1189-08-12	SCREW	FLAT HEAD	
		6	NAS1190-08-4	SCREW	PAN HEAD	

Aluminum Alloy; 6061-T4

FINISH IS 250

TOLERANCE; ± .03, EXCEPT AS NOTED

PARTS LIST

DWN		SCALE		SHEET
ENGR				
APPD				

REV LTR

		QTY	PART NUMBER	DESCRIPTION	SPECIFICATION	REV
	-30	1	-26	cutter arm rework	Bell Labs Diamond Knife Victory Diamond Tool Co. P. O. Box 274 East Hanover, N.J. 07936	
	-26	1	-27	balance screw	6-32 UNCx2.50 LONG	
	-26	1	-28	cutter arm weight	.45 DIAx.48 LONG ST. STEEL	
	- 1	1	-30	mechanical stage MA88	Swift Mechanical Stage College Biological Supply 21707 Bothell Way Bothell, Washington 481-0731	
	- 1	1	-31	3" radius block	1.20x.85x.74 Al. Alloy	
	- 1	1	-32	1.5" radius block	1.20x.85x.74 Al. Alloy	
	- 1	1	-33	.75" radius block	1.20x.85x.74 Al. Alloy	
	- 1	1	2059	toggle clamp	De Sta Co Campbell Industrial Supply 3433 Airport Way So. Seattle, Washington 98134 447-7100	
	-12 -30	2 1	-	CIRCLIP	1/8" DIAMETER	
	- 5	1	-	GROMMET	.60" DIA, RUBBER	
	-21	1	4-40	SCREW	SLOT HEAD, TEFLON	
	-22	1	6-32	SCREW	SLOT HEAD, TEFLON	
	-26	1	6-32	SCREW	FLAT HEAD, 2.5 LONG	
	-12	2	Ms24585C29	SPRING		
		1	MS24677-1	SCREW	SOCKET HEAD	
		2	MS24677-7	SCREW	SOCKET HEAD	
		6	MS24677-10	SCREW	SOCKET HEAD	
		1	MS24677-14	SCREW	SOCKET HEAD	
		2	MS24677-17	SCREW	SOCKET HEAD	

PARTS LIST

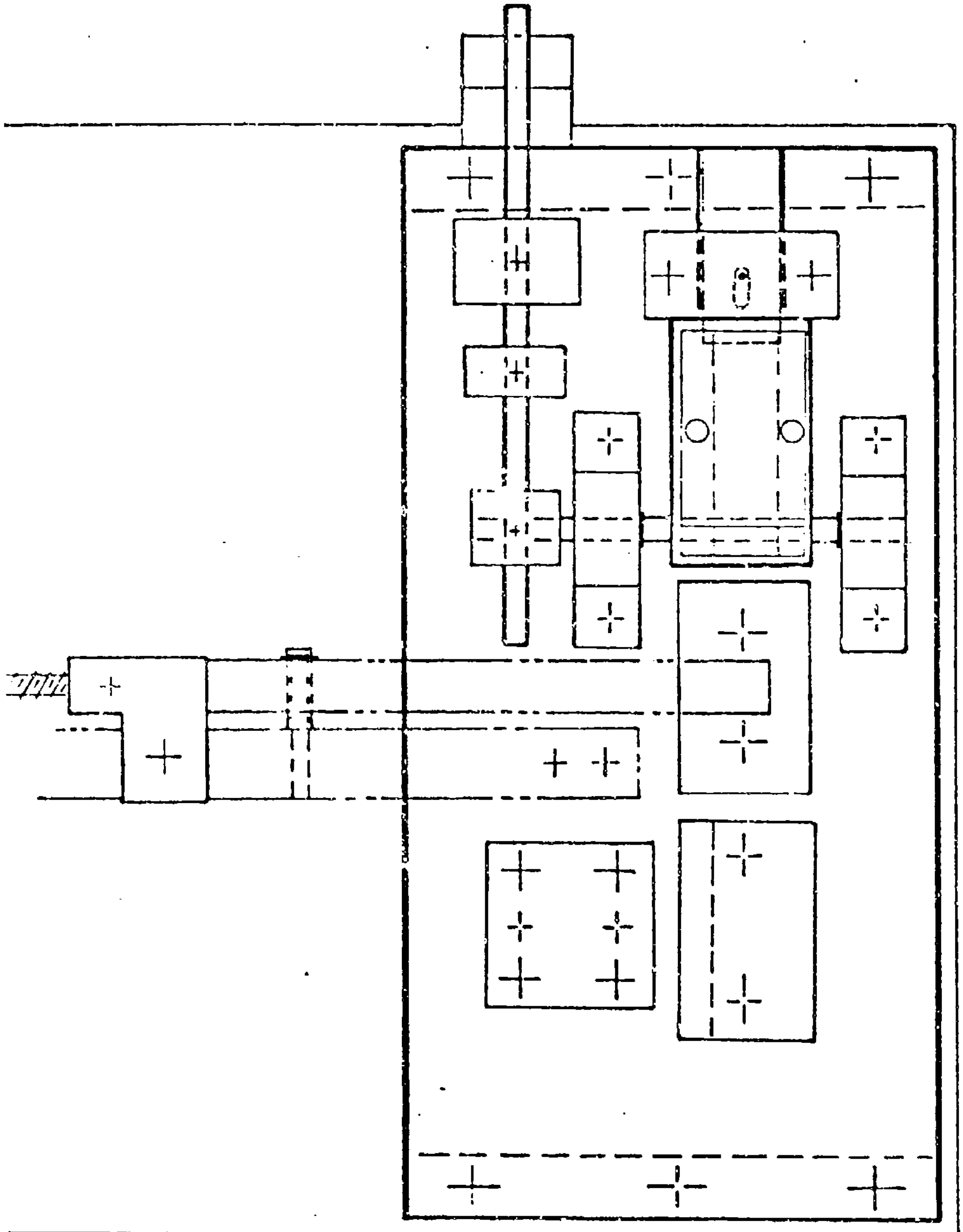
DWN		SCALE		SHEET
ENGR				
APPD				

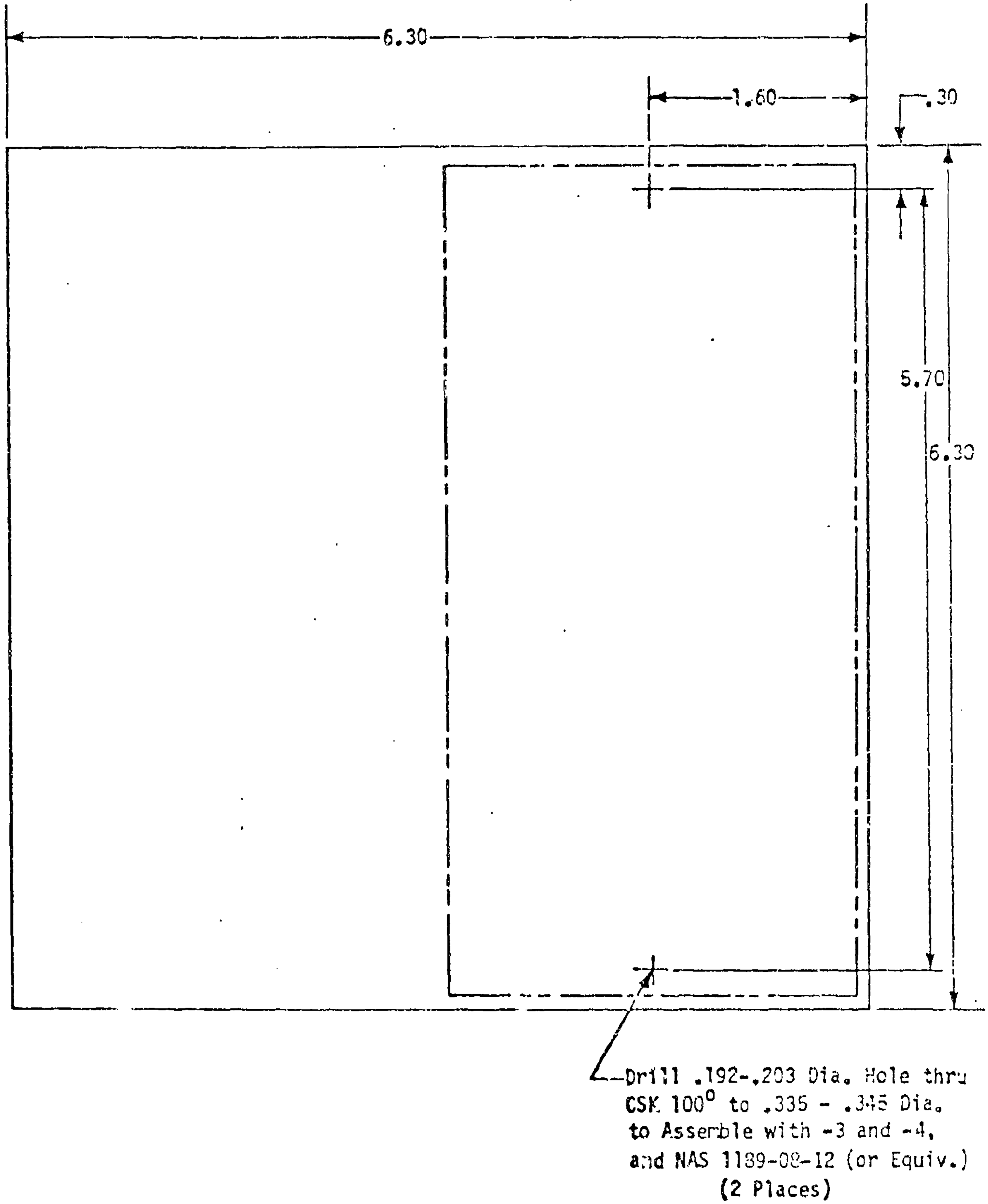
REV LTR

		QTY	PART NUMBER	DESCRIPTION	SPECIFICATION	REV
	-	1	- 1	optical fiber cutter	-	
	- 1	1	- 2	base bo[illegible]	6.5 x 6.5 x 3/8 plywood	
	- 1	1	- 3	end support	3.0x1.5x.36 Al. Alloy	
	- 1	1	- 4	end support with restraint	3.0x1.5x.36 Al. Alloy	
	- 1	1	- 5	restraint	1.75x.75x.60 Al. Alloy	
	- 1	1	- 6	mounting plate	6.06x3.0x.36 Al. Alloy	
	- 1	1	- 7	clamp base	.96x.94x.78 Al. Alloy	
	- 1	1	- 8	fiber restraint base	1.24x.76x.74 Al. Alloy	
	- 1	1	- 9	fiber restraint	1.24x.76x.25 Al. Alloy	
	- 1	1	-10	slide plate retainer	1.10x.50x.10 stainless steel	
	- 1	1	-11	slide plate	1.12x.48x.10 stainless steel	
	- 1	1	-12	tension clamp assembly	-	
	-12	1	-14	lever bar	1/8"DIAx3.6 LONG stainless steel	
	-12	1	-15	mounting bar	1/8"DIAx2.45 stainless steel	
	-12	1	-16	mounting bar support	1.36x.85x.36 stainless steel	
	-12	1	-17	bar end support	1.36x.85x.36 stainless steel	
	-12	1	-18	tension clamp block	1.25x.75x.74 Al. Alloy	
	-12	1	-19	tension clamp	1.10x.25x.74 Al. Alloy	
	-12	1	-20	bar joint	1.10x.50x.42 Al. Alloy	
	-12	1	-21	small weight	.56DIAx.28 LONG stainless steel	
	-12	1	-22	large weight	.70DIAx.50 LONG stainless steel	
	-30	1	-23	cutter arm block	1.0x.80x.25 Al. Alloy	
	-26	1	-24	bushing - -	bronze 1/8 I.D.x.35 LONG	
	-30	1	-25	pivot pin	1/8 DIAx1.0 LONG stainless steel Rod	

PARTS LIST

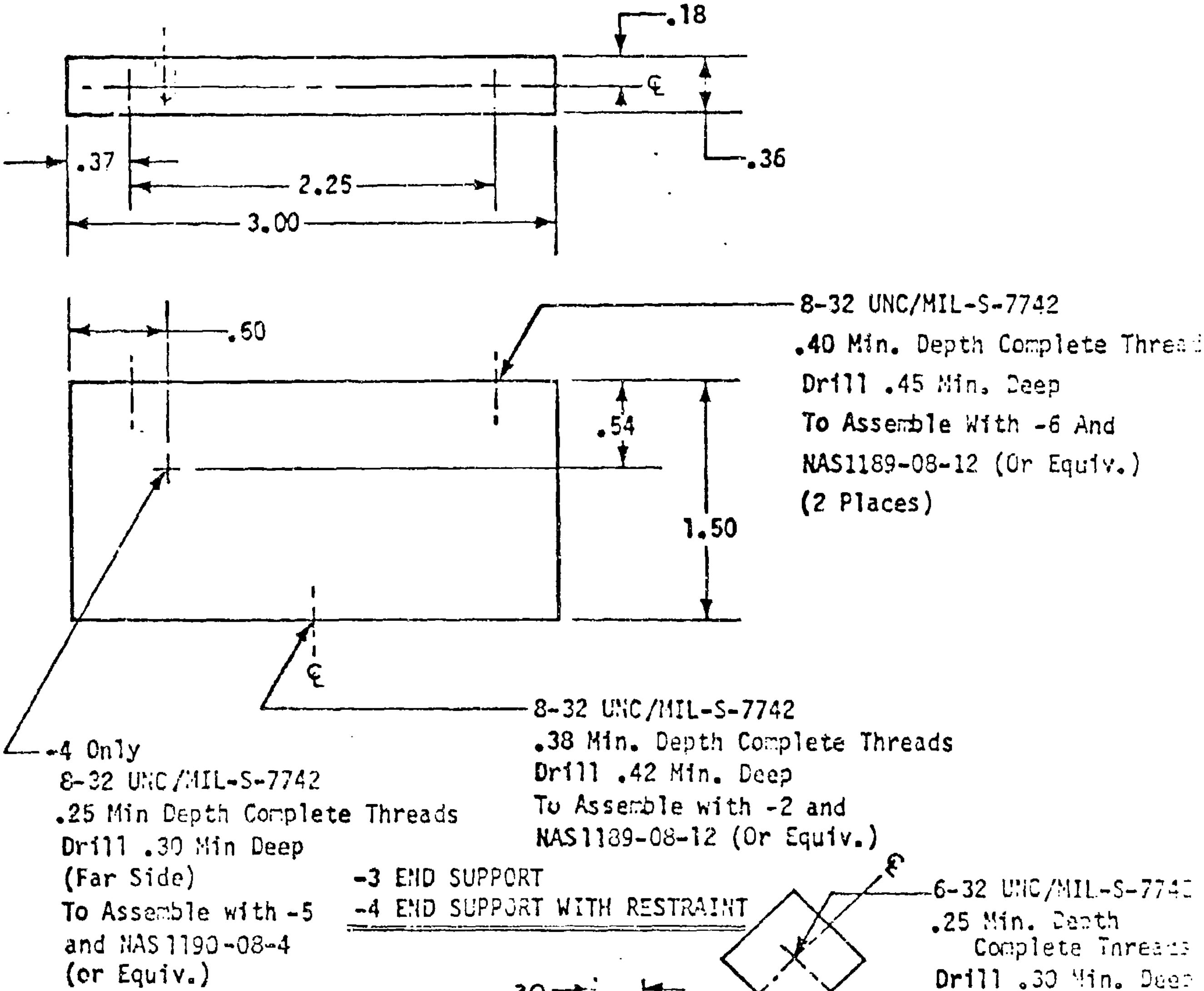
DWN		SCALE	SHEET
ENGR			
APPD			



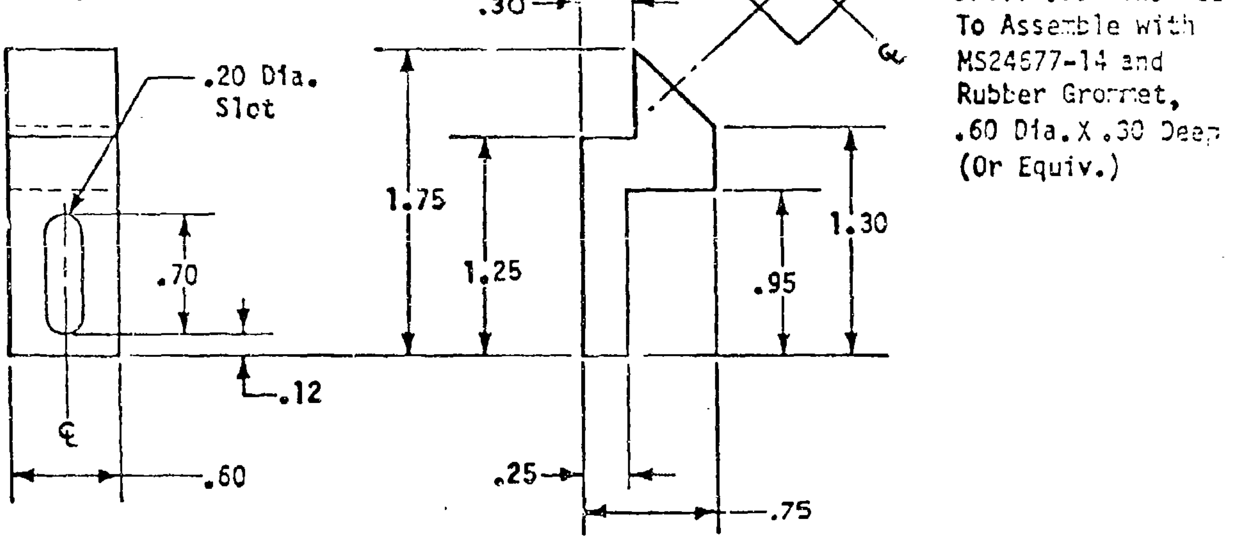


-2 BASE BOARD

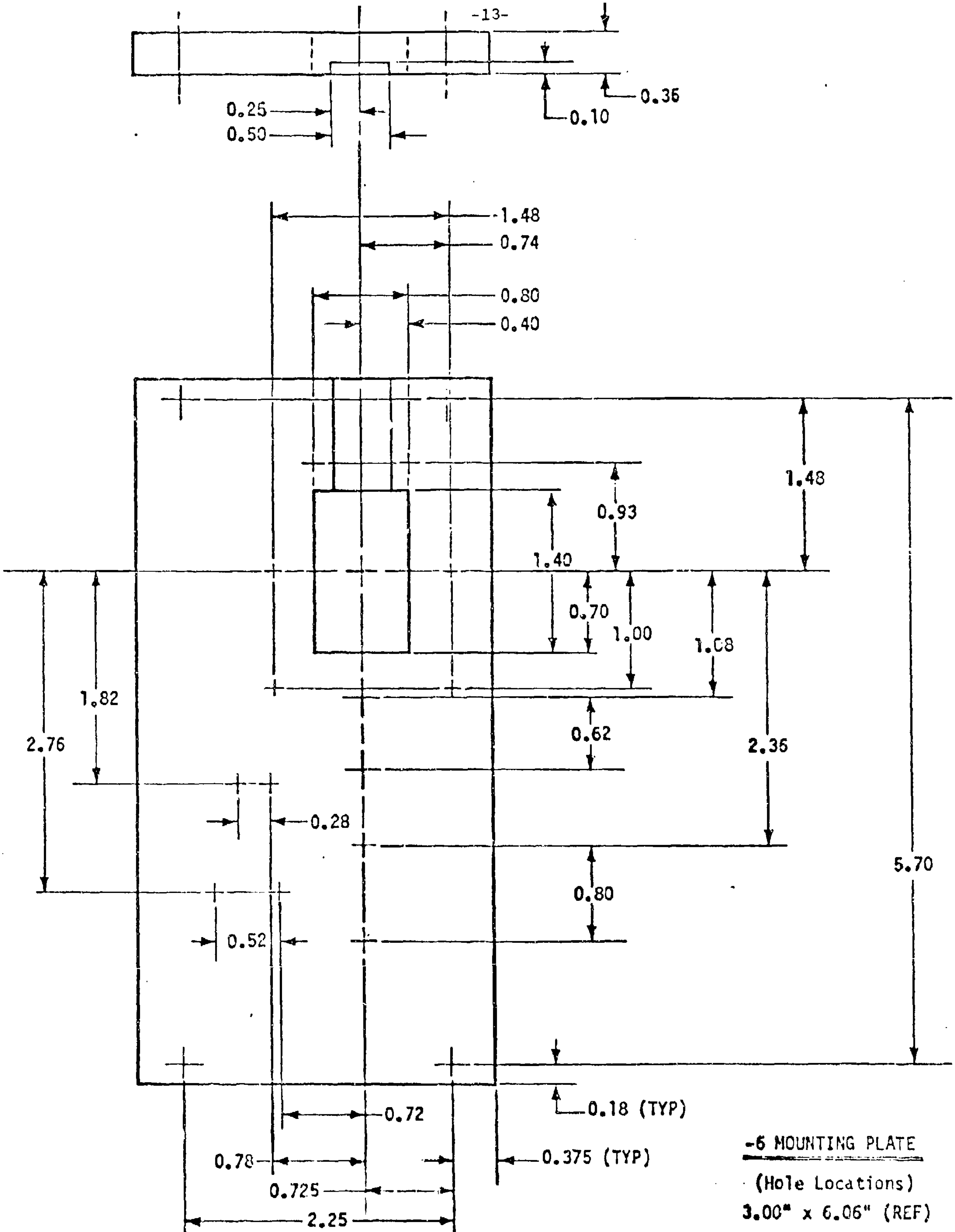
3/8 Plywood (Material Optional)



-3 END SUPPORT
-4 END SUPPORT WITH RESTRAINT



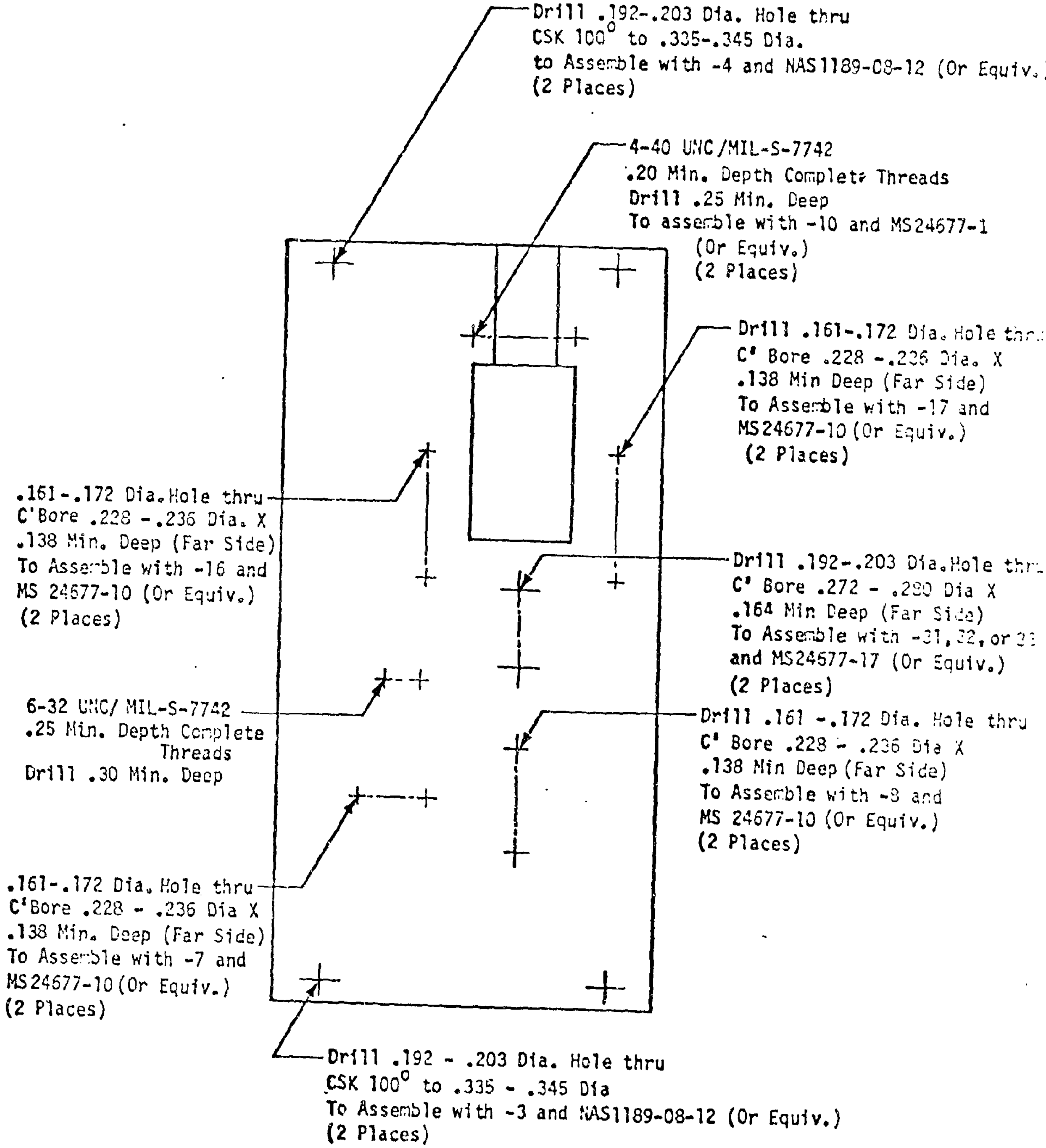
-5 RESTRAINT



-6 MOUNTING PLATE

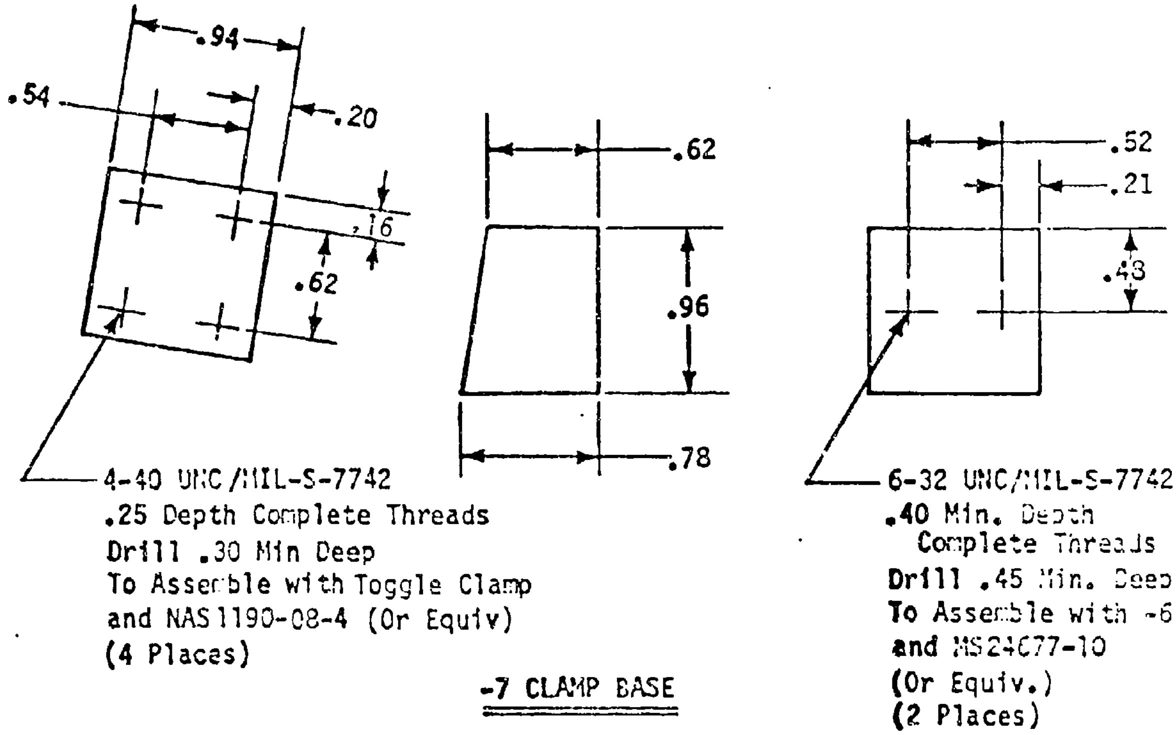
(Hole Locations)

3.00" x 6.06" (REF)

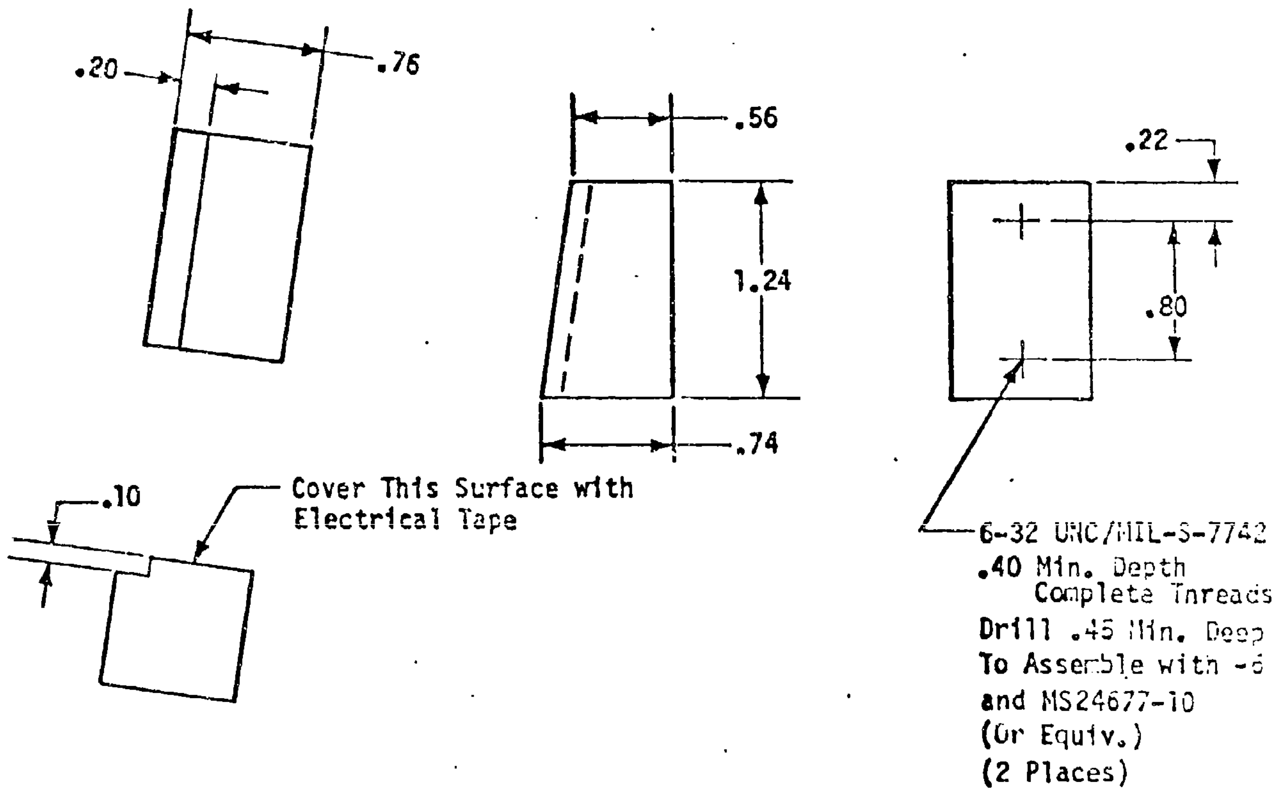


-6 MOUNTING PLATE

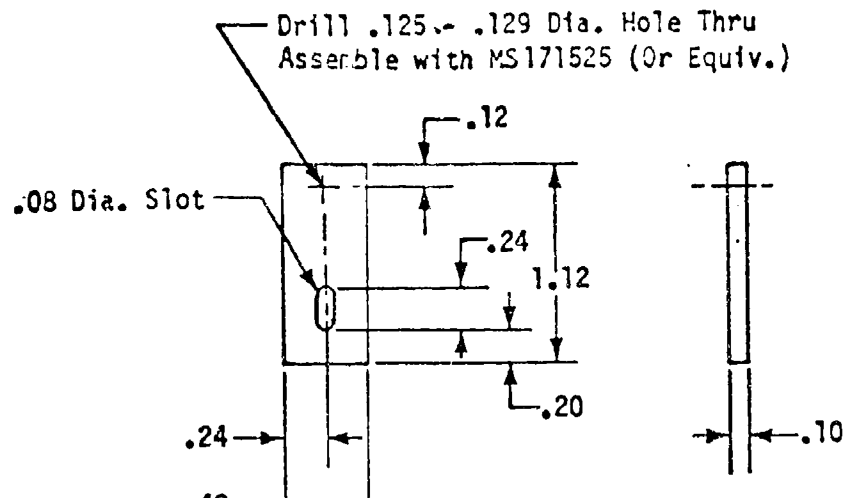
(FASTENERS)



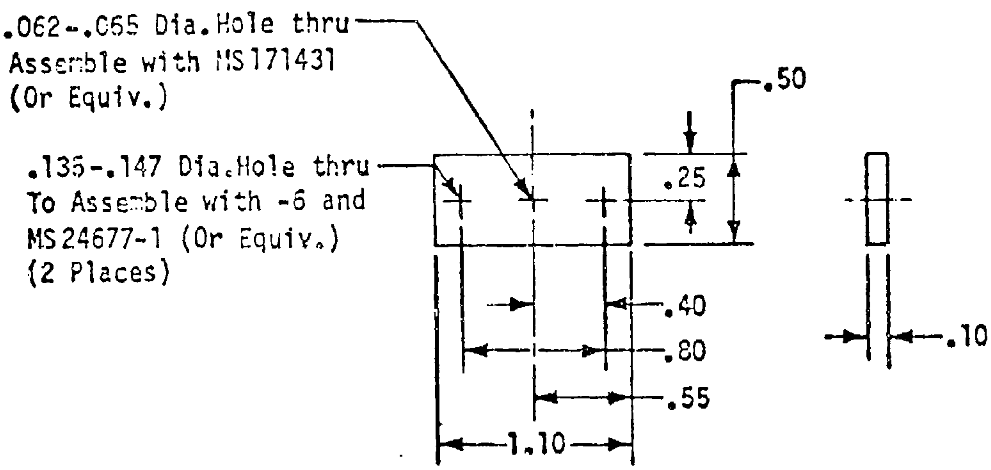
-7 CLAMP BASE



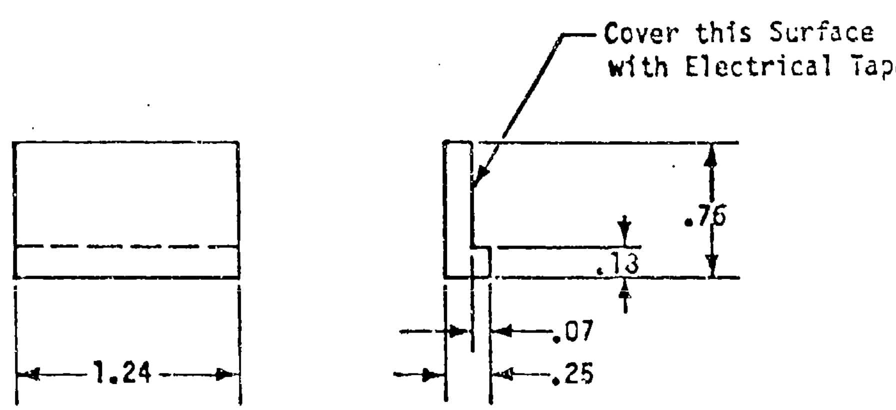
-8 FIBER RESTRAINT BASE



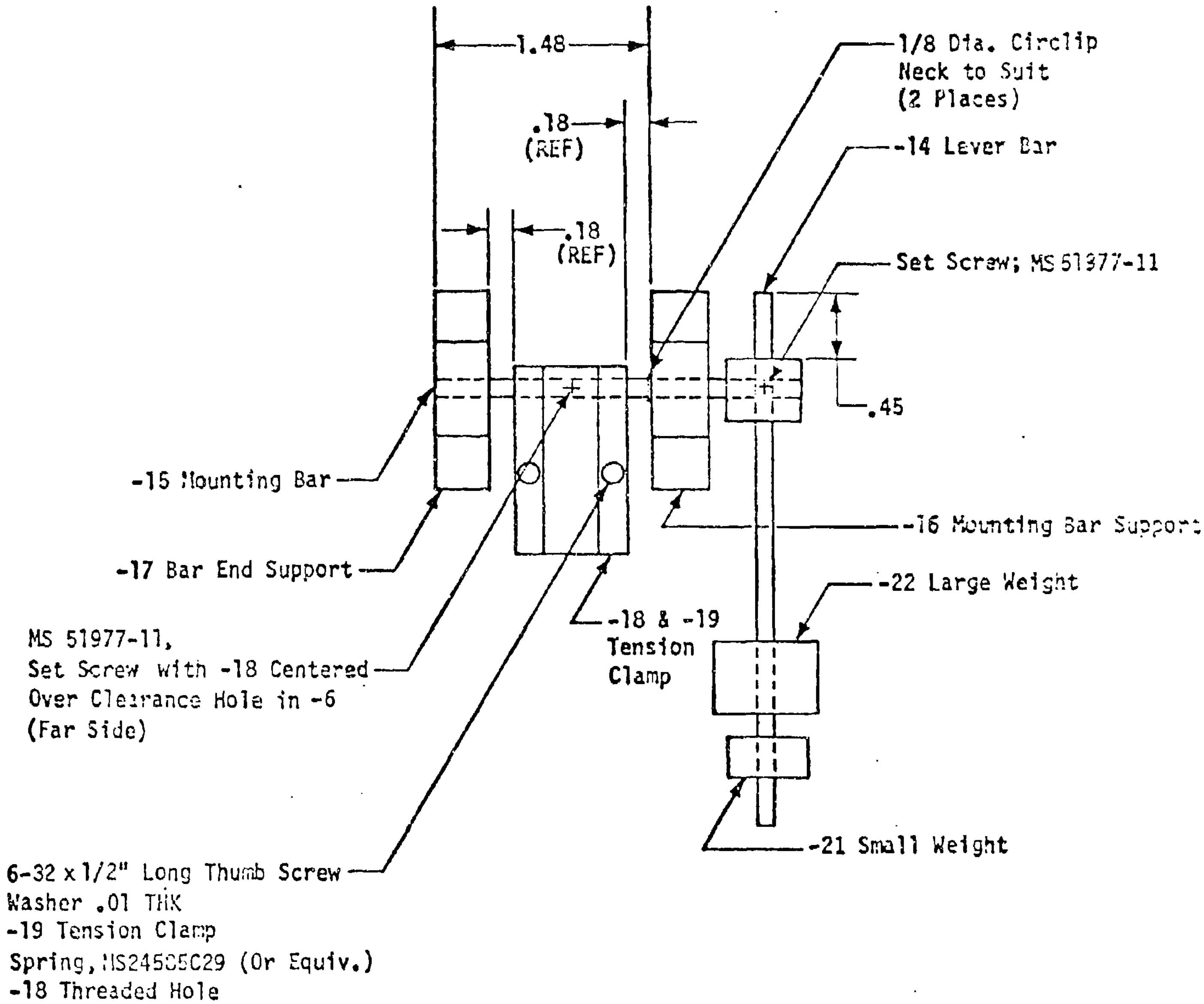
-11 SLIDE PLATE



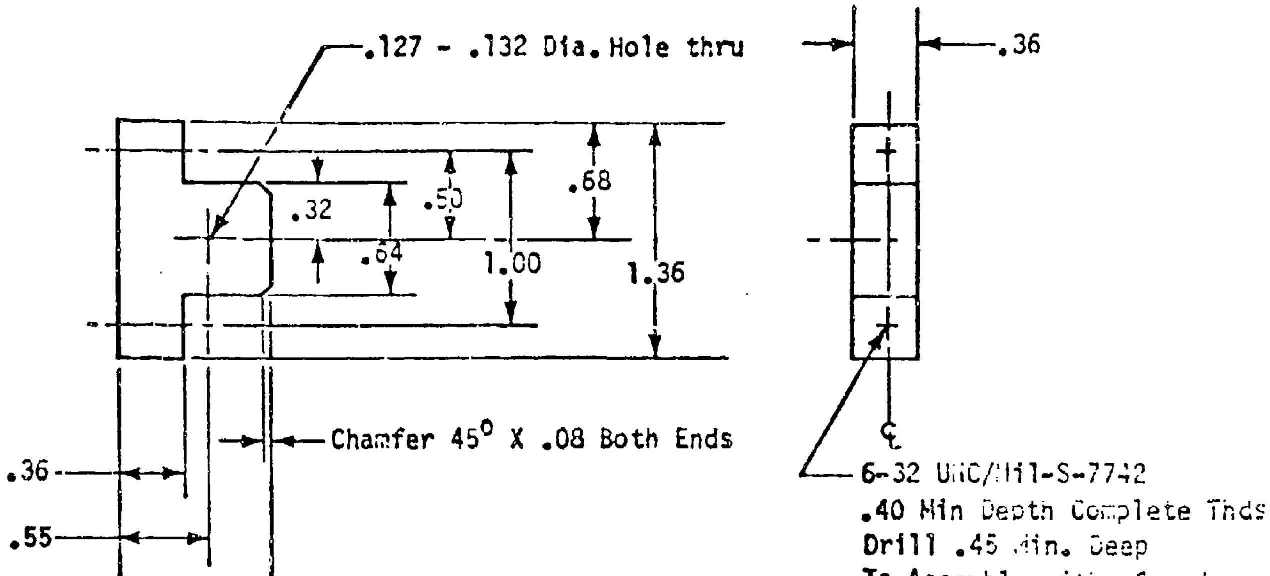
-10 SLIDE PLATE RETAINER



-9 FIBER RESTRAINT

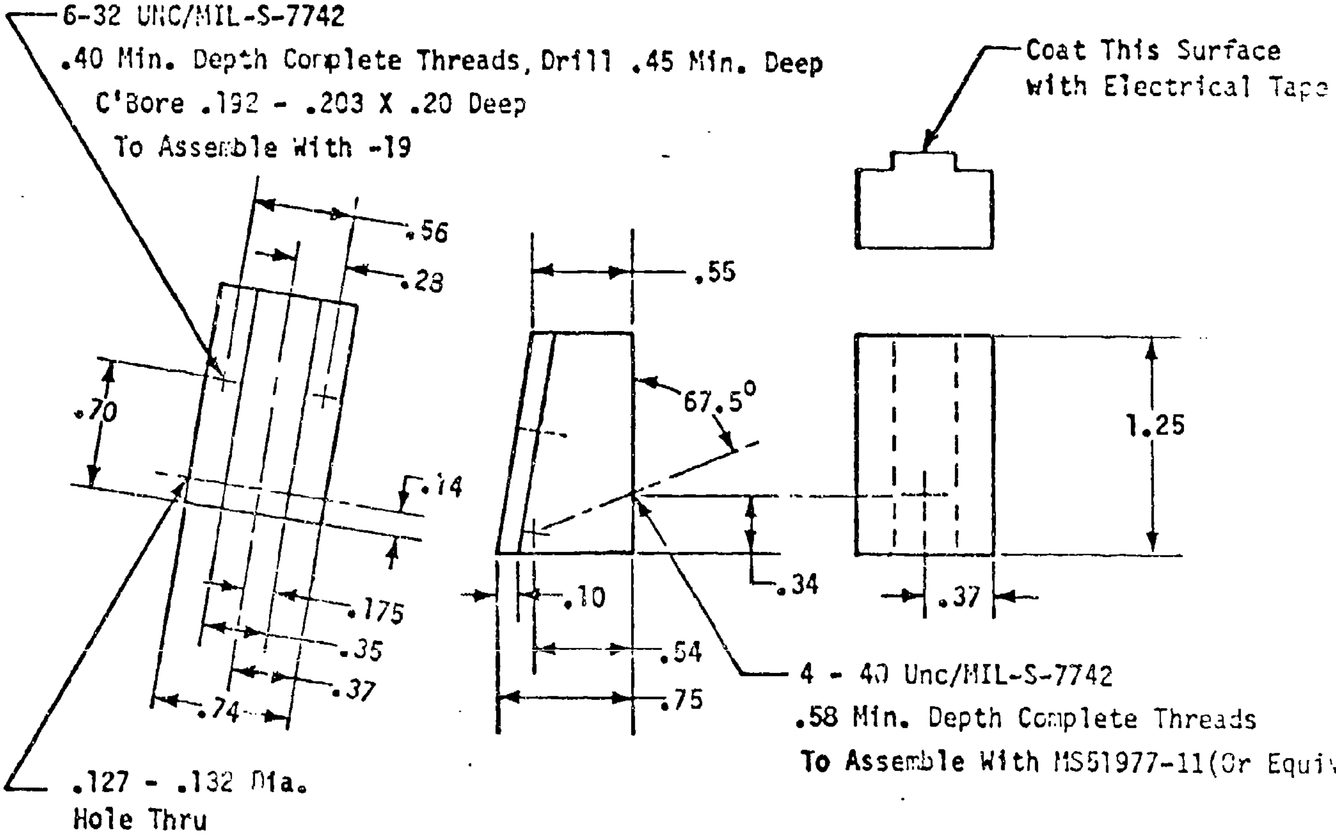


-12 TENSION CLAMP ASSEMBLY

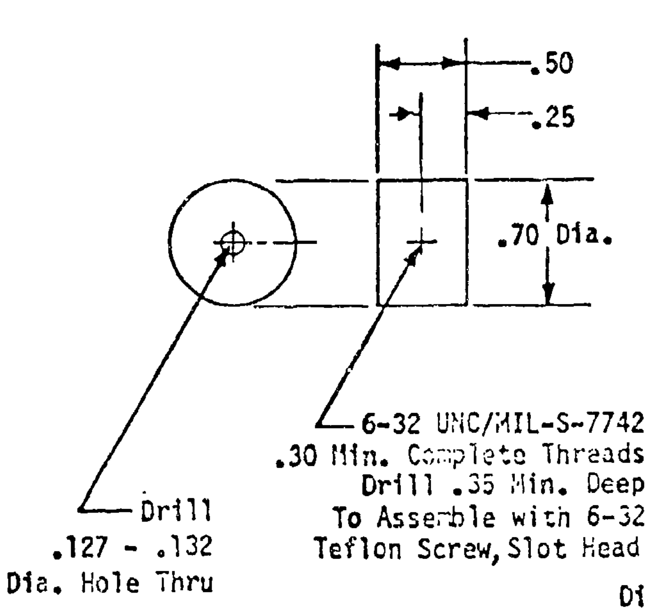


-16 MOUNTING BAR SUPPORT

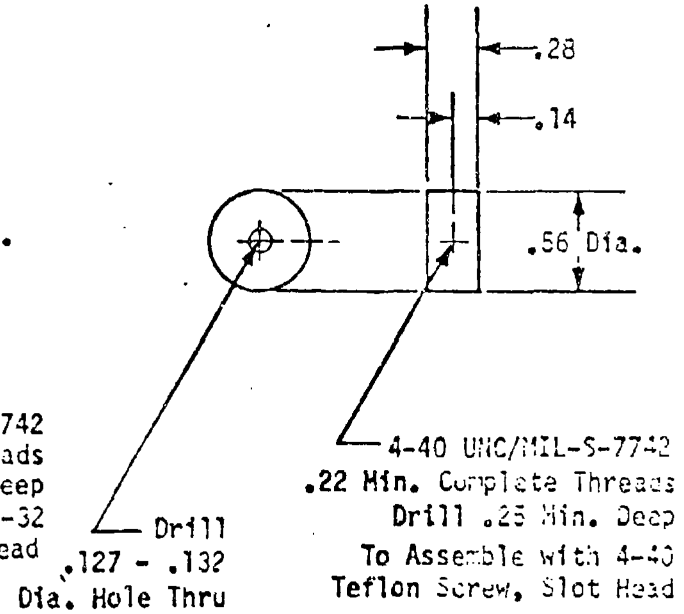
-17 BAR END SUPPORT



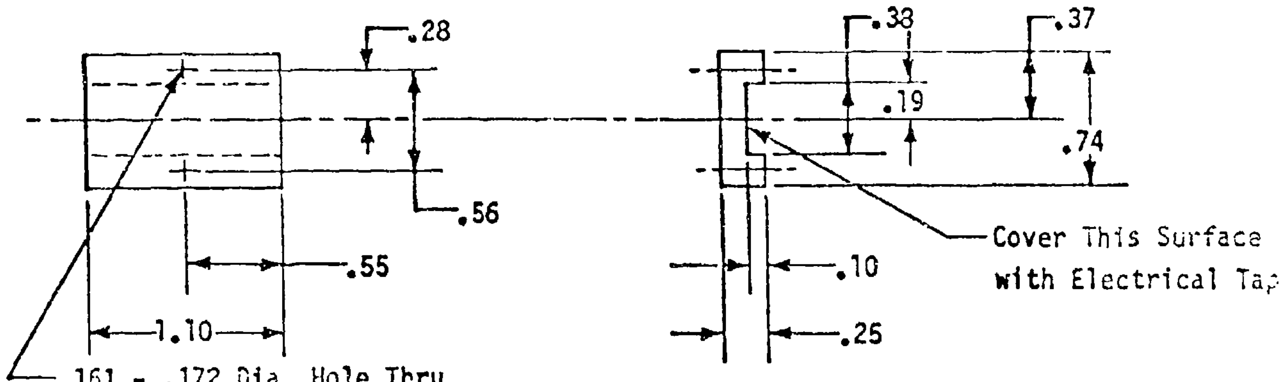
-18 TENSION CLAMP



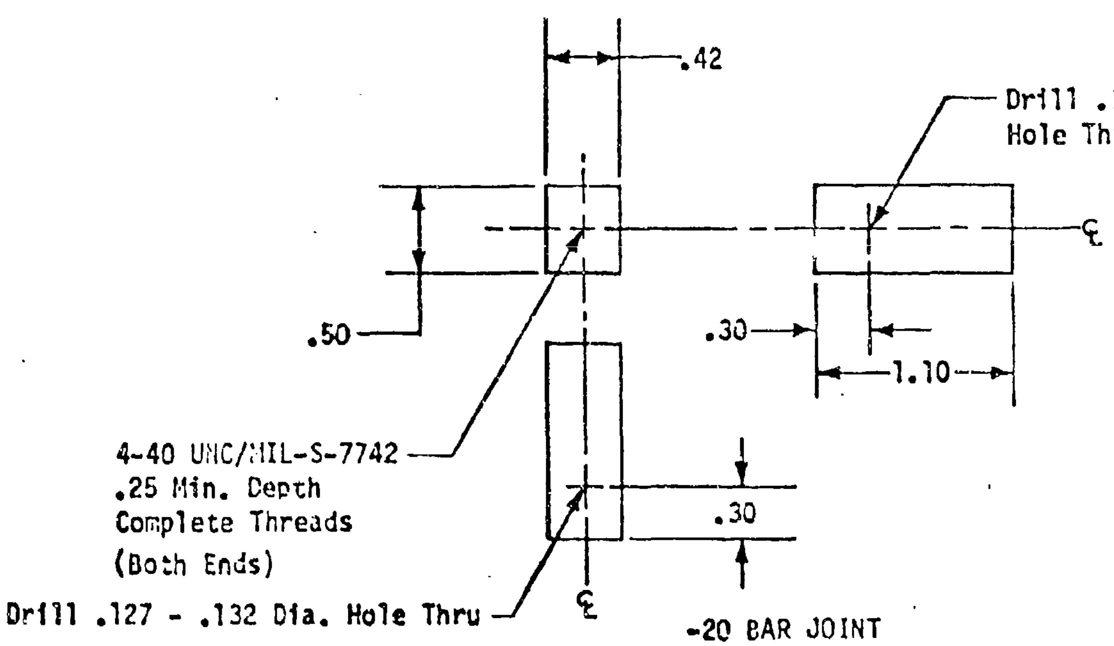
-22 LARGE LEVER BAR WEIGHT



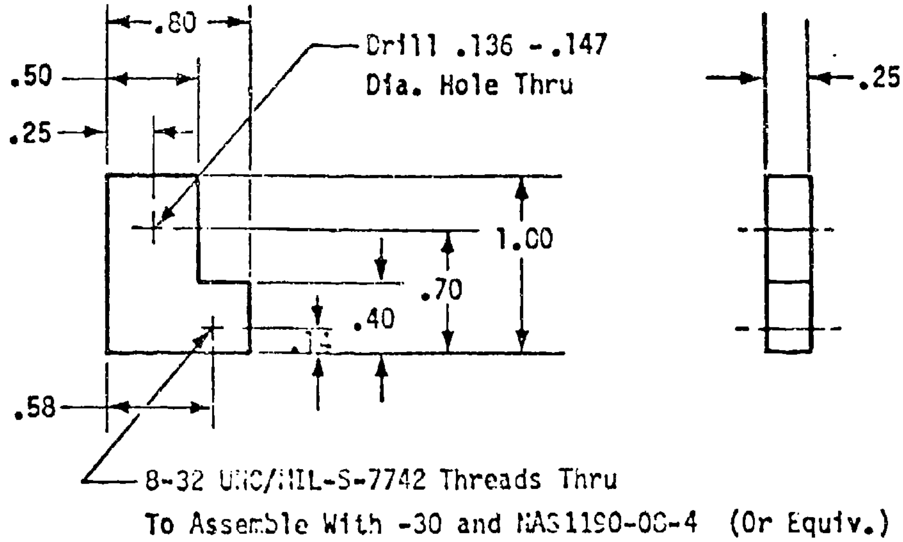
-21 SMALL LEVER BAR WEIGHT



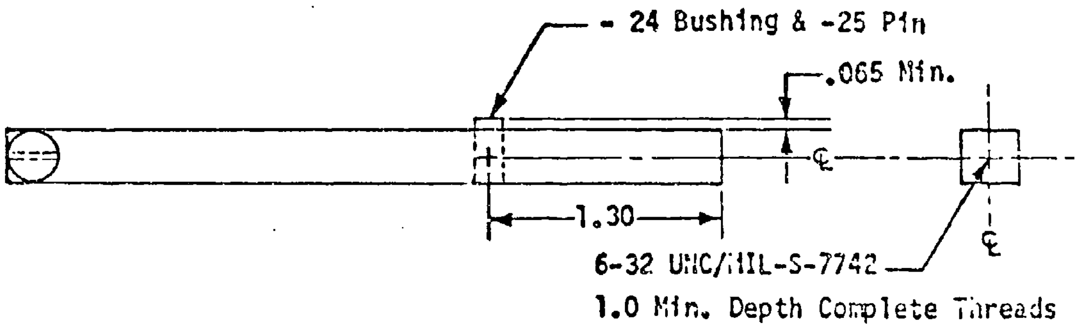
-19 TENSION CLAMP



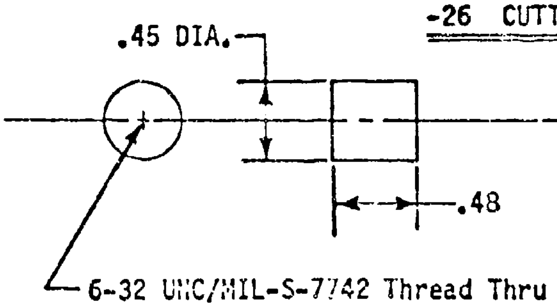
-20 BAR JOINT



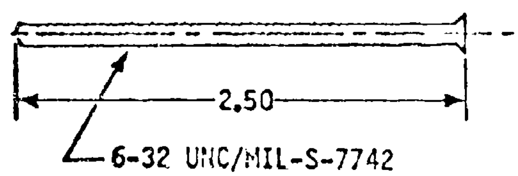
-23 CUTTER ARM ATTACHING BLOCK



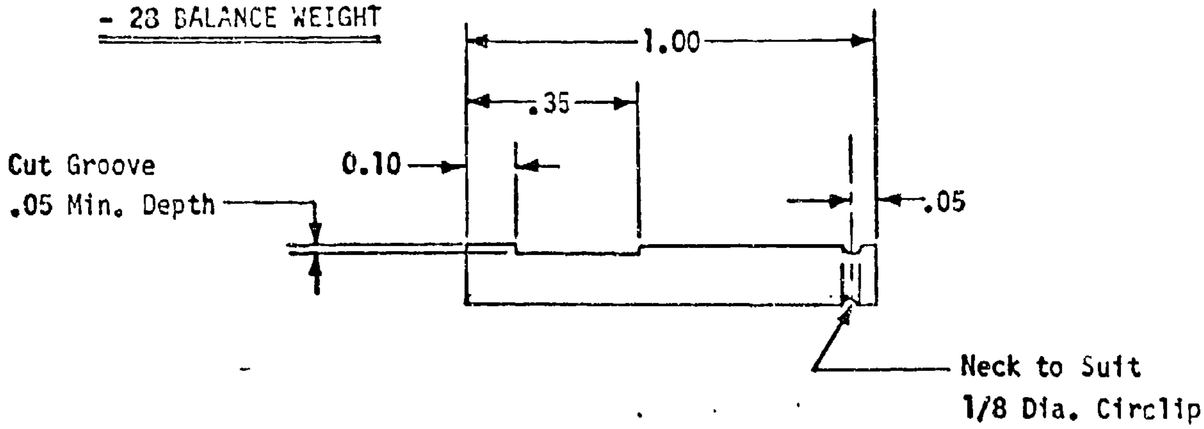
-26 CUTTER ARM REWORK



- 28 BALANCE WEIGHT



- 27 CUTTER ARM BALANCE SCREW



-25 PIVOT PIN

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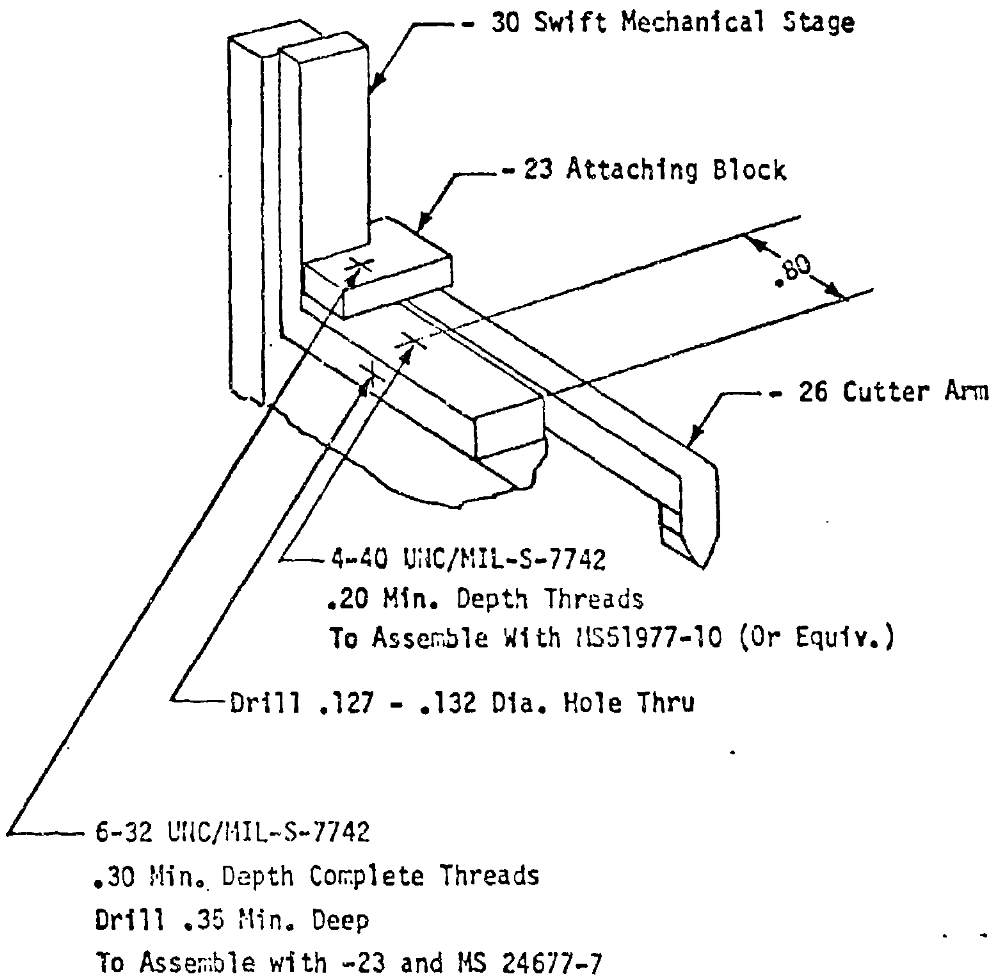
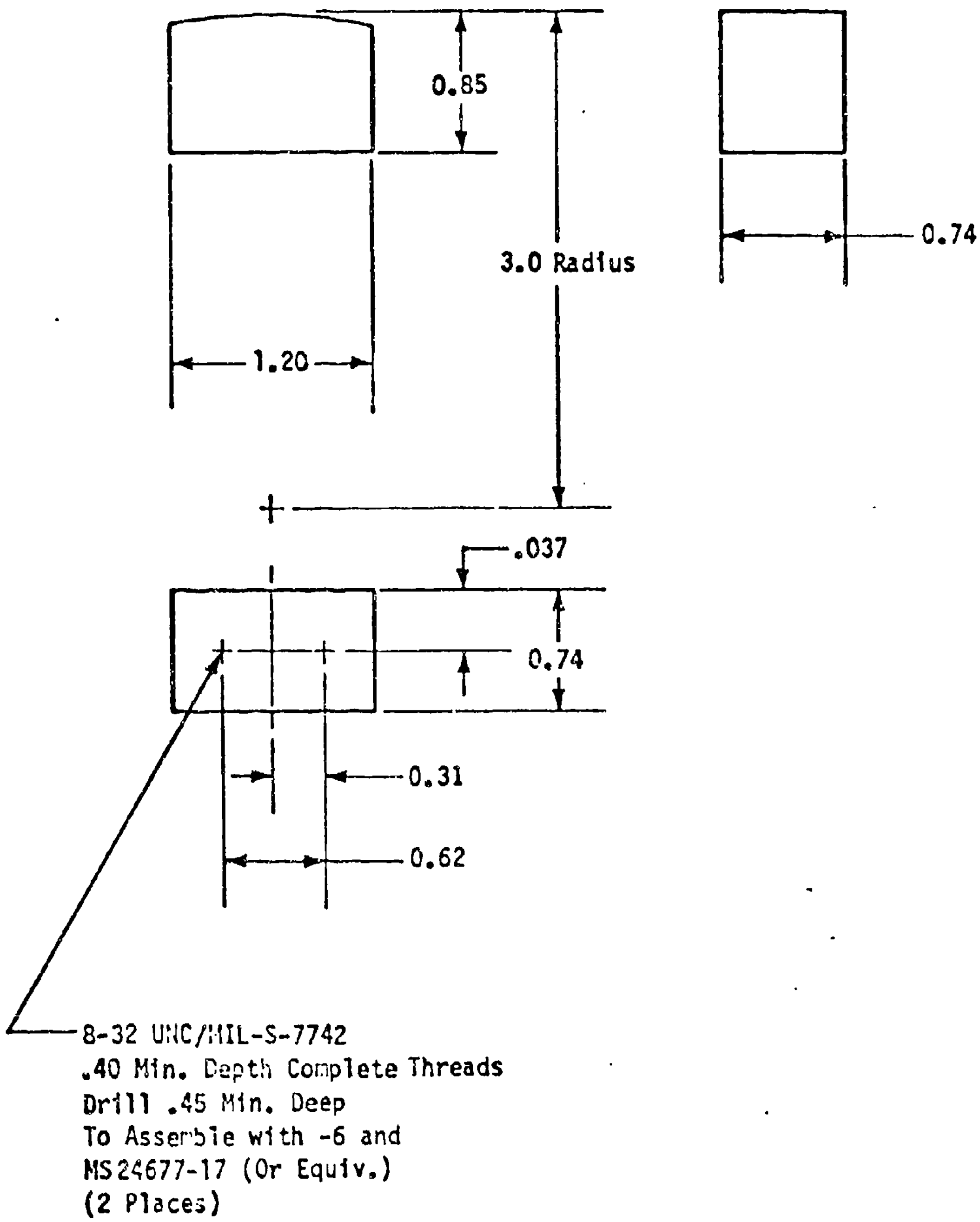
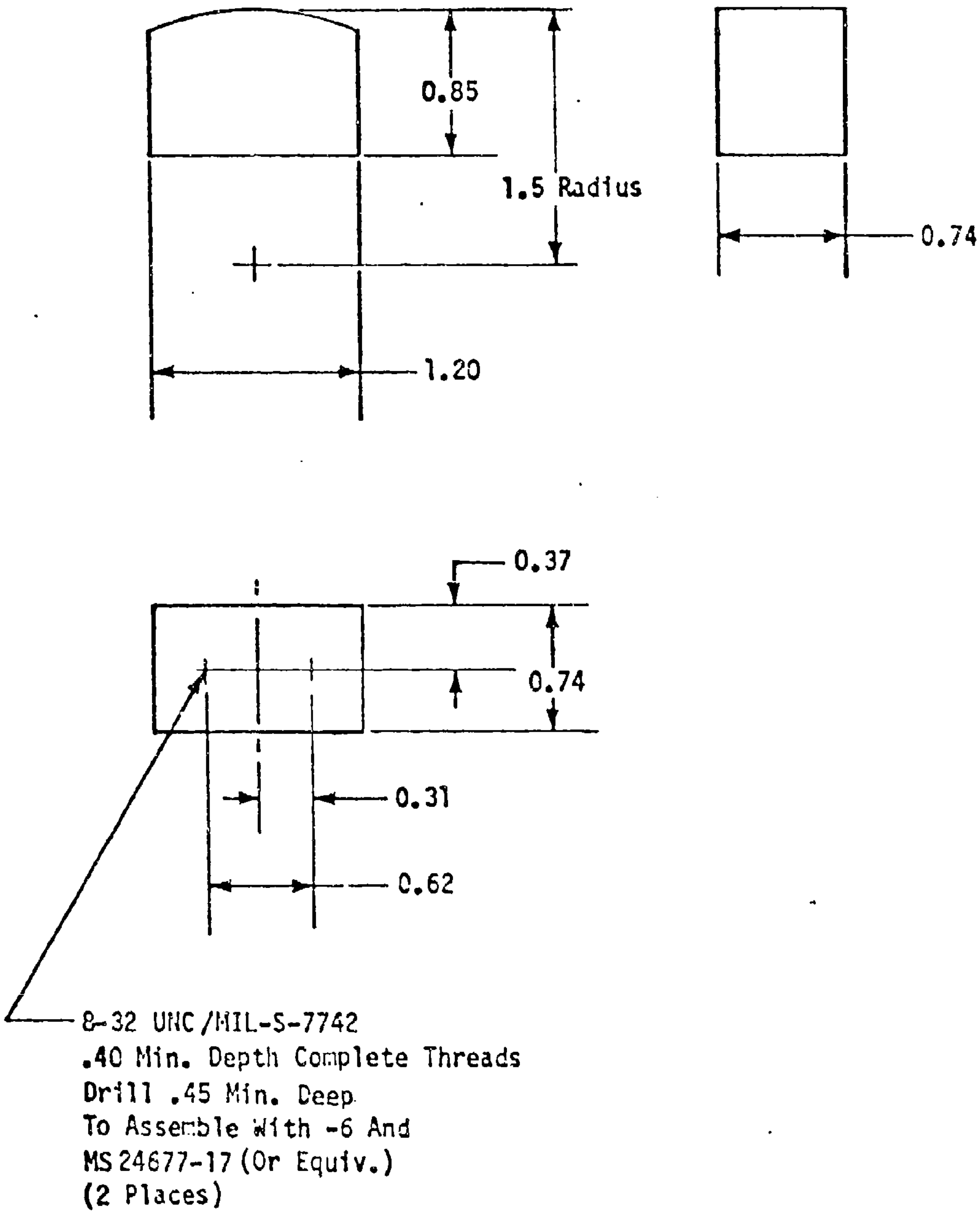


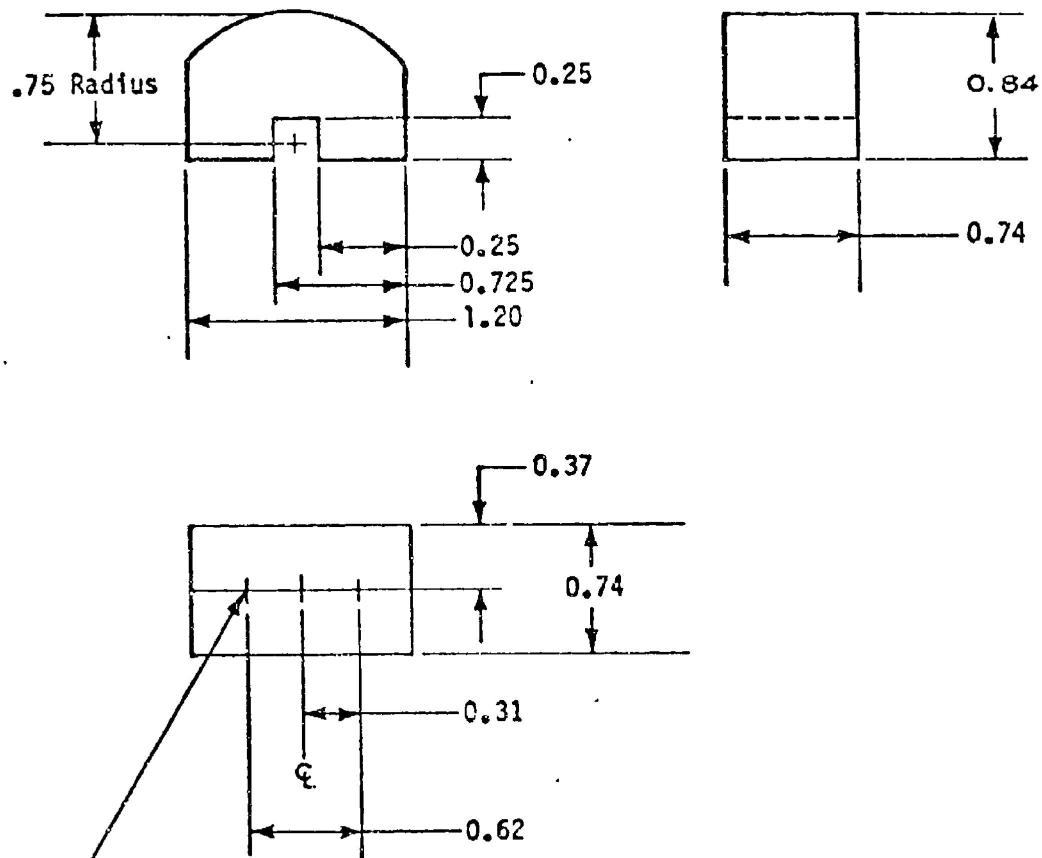
- 30 SWIFT MECHANICAL STAGE REWORK


0.85
3.0 Radius
0.74
1.20
.037
0.74
0.31
0.62
8-32 UNC/MIL-S-7742
.40 Min. Depth Complete Threads
Drill .45 Min. Deep
To Assemble with -6 and
MS24677-17 (Or Equiv.)
(2 Places)

-31 BLOCK


0.85
1.5 Radius
1.20
0.74
0.37
0.74
0.31
0.62
8-32 UNC/MIL-S-7742
.40 Min. Depth Complete Threads
Drill .45 Min. Deep
To Assemble With -6 And
MS 24677-17 (Or Equiv.)
(2 Places)

- 32 BLOCK



8-32 UNC/MIL-S-7742
.40 Min. Depth Complete Threads
Drill .45 Min. Deep
To Assemble With -6 and
MS 24677-17 (Or Equiv.)
(2 Places)

-33 BLOCK